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BOURDON TUBE

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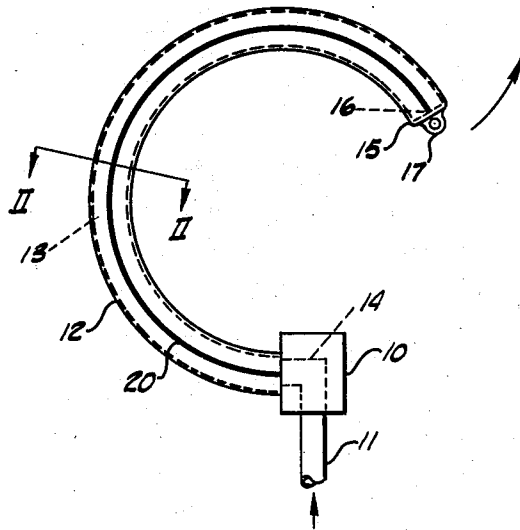


FIG. I

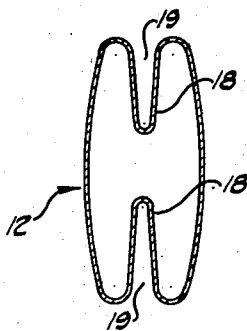


FIG. II

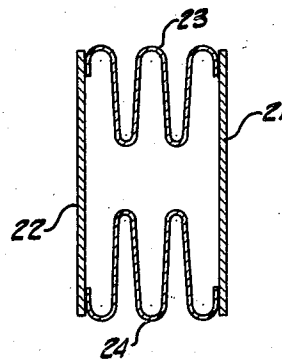


FIG. III

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BOURDON TUBE

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2 Claims. (Cl. 73—418)

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This invention relates to instruments for indicating, controlling, or recording the changes in a variable condition, and has particular reference to devices for translating fluid pressure into mechanical movement.

One form of such devices is the Bourdon pressure tube. It is an object of this invention to provide a new and improved Bourdon pressure tube.

A Bourdon tube may be described as being a curved tube with one end closed and having a transverse cross section which is curved in non-circular contour. The most common form of such cross sections is one that is generally oval in shape. The tube usually has an open end fixed against movement and a closed end which is free to move.

The general principle of action of a Bourdon tube is that fluid pressure applied to the interior of the tube tends to straighten out the main body curve of the tube. This tendency is the result of the tendency of the tube to change its cross section to the form of a circle. The straightening out of the tube under pressure provides an arcuate movement of the free end of the Bourdon, and this movement, since it is representative of the pressure variation within the tube, is utilized to operate an indicator, recorder, or controller, as desired.

This invention provides a Bourdon tube formed with an improved transverse cross-sectional configuration. This results in a substantially greater movement of the free end of the Bourdon per unit of pressure in the tube than has heretofore been possible.

Referring to the drawings:

Figure I is a showing of a Bourdon tube in illustrative embodiment of this invention;

Figure II is a transverse cross section of the tube of Figure I, taken as on line II—II; and

Figure III is a showing of an alternate cross section structure.

Referring to Figure I, at the bottom thereof, there is a mounting block 10, fixed against movement. Leading into the block 10 from below is a fluid pressure inlet conduit 11. Fluid pressure from a condition sensing element, not shown, is introduced into the mounting block 10 through the inlet 11. Secured to one of the sides of the mounting block 10 is a Bourdon tube with the inner tubular passage thereof indicated in dotted lines as at 13. The tube passage 13 is connected to the inlet conduit 11 through the mounting block 10 by means of a connecting passage 14 in that block.

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The Bourdon tube 12 is provided with the well-known C shape, as shown in Figure I, terminating short of a full circle as at 15, with the end 15 free to move in an arc as pressure inside the tube tends to straighten the tube from a C to form a straight line form. The tube 12 at the end 15 is closed as indicated at 16. There is a connector eye 17 secured to the end 15. The arcuate movement of the tube end 15 may be transferred, through suitable connectors to the eye 17, to any suitable devices for indicating, controlling, or recording.

Referring to Figure II, the essence of this invention is in the cross-sectional configuration shown there. The cross section is generally oval in shape, with V folds 18 extending inwardly of the tube from the long radius portions 19 of the oval. The V folds 18 extend throughout the length of the Bourdon tube 12 as indicated in Figure I by the central line 20. The V folds extend their vertices toward the axis of the tube 12, and toward each other.

Thus there are provided, throughout opposite walls of the tube 12, inward folds of the tube such that the transverse cross section of the tube is essentially a bellows formation. Tests have demonstrated that a Bourdon tube formed in accordance with this invention may provide as much as four times the movement of the free end of the Bourdon, per unit of pressure, as is provided in the usual prior art simple oval cross-section tubes.

The bellows formation may be made up of more than one V shape if desired. For example, as in Figure III, the Bourdon tube is formed by two flat springs 21 and 22, bodily curved in parallelism, to a C shape as in Figure I, and joined at their edges by bellows sections 23 and 24, which are each made up of two V formations. The springs 21 and 22 may be concave or convex and may be made of heavier and more rigid material than that of the bellows sections 23 and 24.

The operation of the structure illustrated in Figure III is essentially the same as that of the structure illustrated in Figures I and II. Possible variations in respect to configuration, number of folds, weight of materials, and other variable factors are merely adaptations of this invention to particular sets of factors of pressure and movement as required by particular applications. Such possible variations are many, as is suggested by the differences between Figures II and III.

Such bellows Bourdon tubes may be bodily shaped in any of a variety of forms; for ex-

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ample, circular, spiral, helical, or twisted, without departing from the spirit of this invention as disclosed in this specification and the following claims, taken in the light of the accompanying drawings.

This invention thus might be said to combine the principles of a Bourdon pressure tube and a bellows.

I claim:

1. A C type Bourdon tube with one end fixed and the other end movable in an arc upon the application of fluid pressure change to the interior of said tube; said tube having, in transverse cross section, a noncircular bellows-like configuration with inwardly extending deep V fold portions disposed in general perpendicularity with respect to the plane of said tube end movement arc, whereby said pressure change causes flexing of V folds as defined by said V fold portions, in bellows-like action as a factor in the response of said tube to said pressure change.

2. A Bourdon tube with one portion fixed and another portion movable in a predetermined plane upon the application of fluid pressure change to the interior of said tube; said tube

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having, in transverse cross section, a noncircular bellows-like configuration comprising opposed width portions disposed in general perpendicularity with respect to said predetermined plane of movement of said movable portion of said tube, and inwardly extending deep V-fold portions disposed between said width portions and in general perpendicularity with respect to said predetermined plane of movement of said movable portion of said tube whereby said pressure change causes flexing of V-folds as defined by said V-fold portions, in a bellows-like action as a factor in the response of said tube to said pressure change.

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